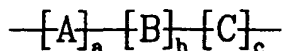


**What is claimed is:**

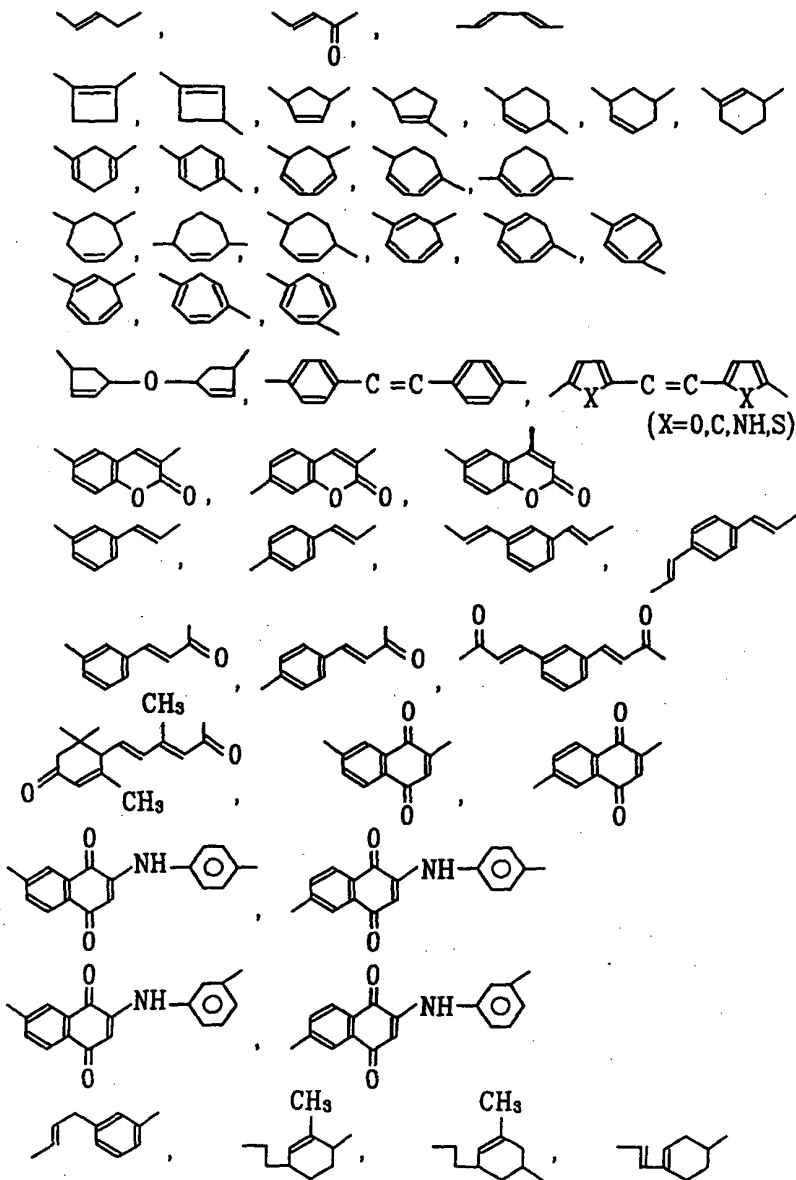
1. A photo-alignment material having a photo-reactive ethenyl group on a polymer main chain, wherein the polymer is in accord with chemical formula 1:

{chemical formula 1}



wherein subscripts a, b, and c denote a component ratio of respective monomers, wherein  $0 < a \leq 1$ ,  $0 \leq b < 1$ , and  $0 \leq c < 1$ , and wherein component A is a monomer including a photo-reactive ethenyl group selected from groups designated in chemical formula 2, substituted-structure groups of chemical formula 2 having a halogen, a cyano, a nitro, an amino group, and other substituted-structure groups with an alkyl, a haloalkyl, and a cyanoalkyl group having 1 to 10 carbons, or an aryl, an alkyl, an aryl, a haloaryl, a haloalkyl aryl, a nitroaryl, and a cyanoaryl group having 3 to 8 carbons;

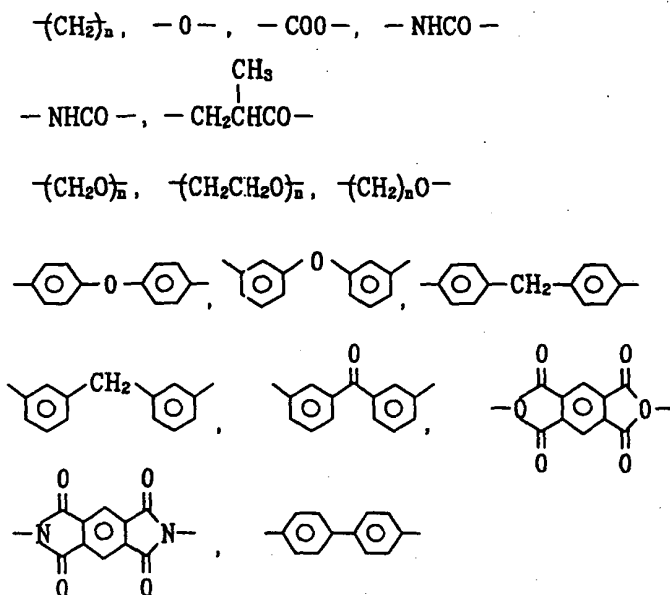
{Chemical Formula 2}



2. The photo-alignment material of claim 1, wherein components B and C are selected independently from groups shown in chemical formula 3, substituted-structure groups of chemical formula 3 with a halogen, a cyano, a nitro, an amino group, other substituted-structure groups with carbonated groups of which carbon number n lies between 1

and 10 such as an alkyl, a haloalkyl, and a cyanoalkyl, and other carbonated groups of which carbon number lies between 3 and 8 such as an alkylaryl, a haloaryl, a haloalkylaryl, a nitroaryl, and a cyanoaryl;

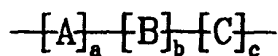
{Chemical Formula 3}



3. A liquid crystal display device comprising:
  - a first substrate;
  - a second substrate;
  - a liquid crystal layer between the first and second substrates; and
  - a photo-alignment layer on the first substrate, wherein the photo-alignment layer includes an ethenyl group on a main chain.

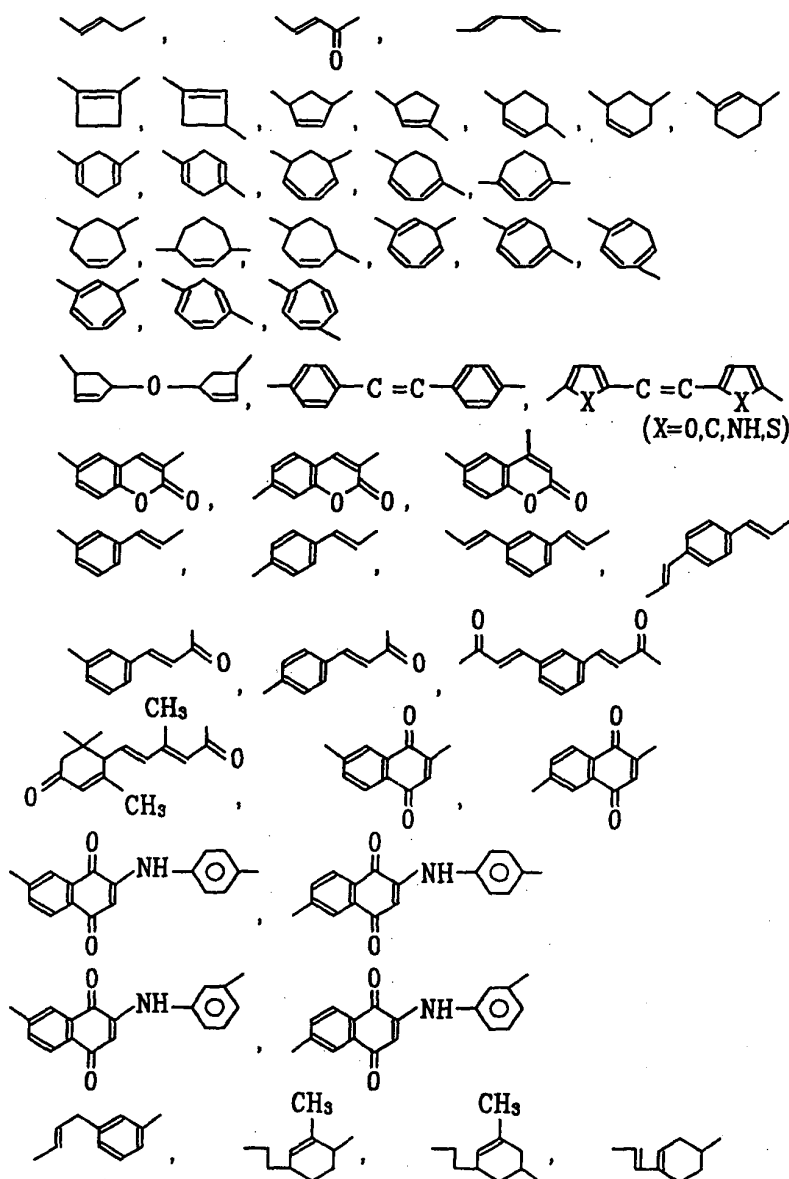
4. The device of claim 3, wherein the photo-alignment layer is formed of material having a photo-reactive ethenyl group on a polymer main chain, wherein the polymer is according to following chemical formula 1:

{chemical formula 1}



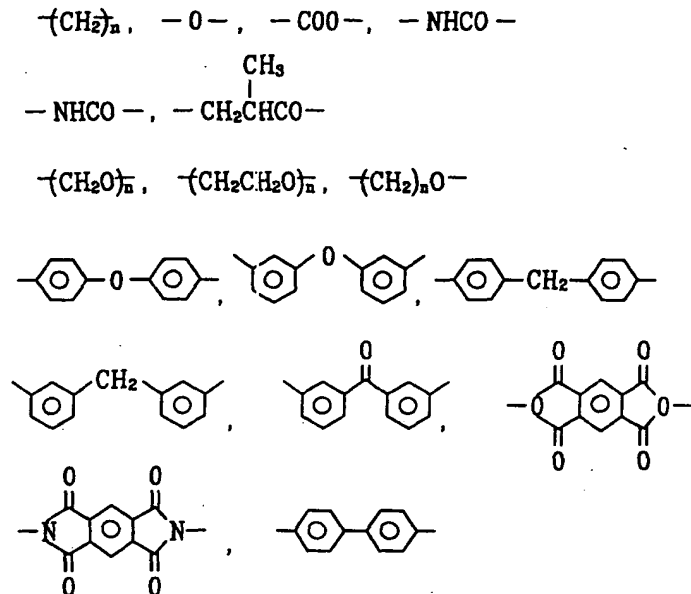
wherein subscripts a, b, and c denote a component ratio of respective monomers, wherein  $0 < a \leq 1$ ,  $0 \leq b < 1$ , and  $0 \leq c < 1$ , and wherein component A is a monomer including the photo-reactive ethenyl group, selected from groups designated in chemical formula 2, substituted-structure groups of the chemical formula 2 with a halogen, a cyano, a nitro, an amino group, and other substituted-structure groups with an alkyl, a haloalkyl, a cyanoalkyl group having 1 to 10 carbons, or an aryl, an alkyl, an aryl, a haloaryl, a haloalkyl aryl, a nitroaryl, a cyanoaryl group having 3 to 8 carbons;

{Chemical Formula 2}



5. The device of claim 4, wherein components B and C are selected from groups shown in chemical formula 3, substituted-structure groups of the chemical formula 3 with a halogen, a cyano, a nitro, an amino group, other substituted-structure groups with carbonated groups of which carbon number n lies between 1 and 10 such as an alkyl, haloalkyl, and cyanoalkyl, and other carbonated groups of which carbon number lies between 3 and 8 such as an alkylaryl, a haloaryl, a haloalkylaryl, a nitroaryl, and a cyanoaryl;

## {Chemical Formula 3}



6. The device of claim 3, further comprising at least one thin film transistor including a gate electrode, a semiconductor layer, a source electrode, and a drain electrode.

7. The device of claim 3, wherein the photo-alignment layer is formed by light-irradiation.

8. The device of claim 7, wherein the light-irradiation is irradiated at least once.

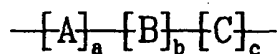
9. The device of claim 7, wherein the light is selected from a group consisting of unpolarized light, non-polarized light, linearly polarized light and partially polarized light,

10. A liquid crystal display device comprising:  
a first substrate;

a second substrate;  
 a liquid crystal layer between the first and second substrates;  
 a photo-alignment layer on the first substrate, the photo-alignment layer having an ethenyl group at a main chain; and  
 a rubbing alignment layer on the second substrate.

11. The device of claim 10, wherein the photo-alignment layer is formed of material having at least a photo-reactive ethenyl group at a polymer main chain, wherein the polymer is denoted by the following chemical formula 1:

{chemical formula 1}



wherein subscripts a, b, and c denote a component ratio of respective monomers, wherein  $0 < a \leq 1$ ,  $0 \leq b < 1$ , and  $0 \leq c < 1$ , and wherein component A, which is a monomer including the photo-reactive ethenyl group, is selected from groups designated in chemical formula 2, substituted-structure groups of chemical formula 2 with a halogen, cyano, nitro, amino group, and other substituted-structure groups with a alkyl and haloalkyl, and cyanoalkyl group having 1 to 10 carbons or an aryl, alkyl, aryl, haloaryl, haloalkyl aryl, nitroaryl, cyanoaryl group having 3 to 8 carbons;

Chemical structures of various monomers and polymers, including alkenes, cycloalkenes, and aromatic compounds. The structures are arranged in rows and columns, showing different ring sizes and substituents. A note indicates that X can be O, C, NH, or S.

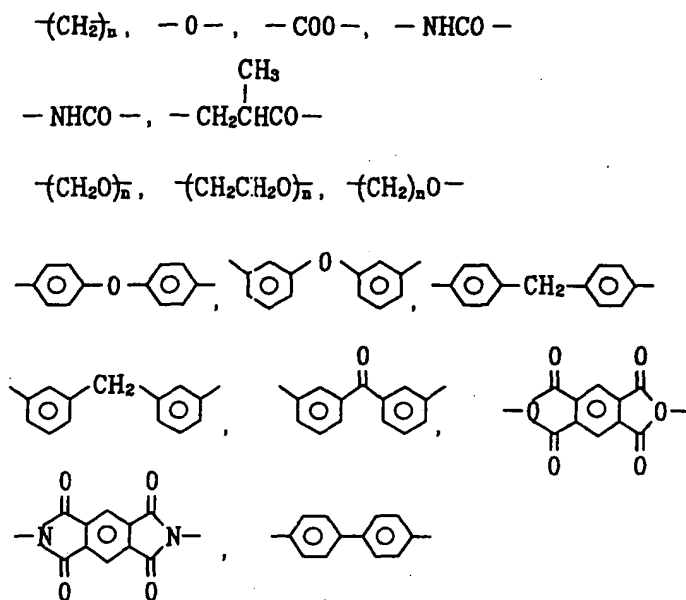
(X=O, C, NH, S)

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alkyl, haloalkyl, and cyanoalkyl, and other carbonated groups of which carbon number lies between 3 and 8 such as an alkylaryl, a haloaryl, a haloalkylaryl, a nitroaryl, and a cyanoaryl;

{Chemical Formula 3}



13. The device of claim 10, further comprising at least one thin film transistor including a gate electrode, a semiconductor layer, a source electrode, and a drain electrode.

14. The device of claim 10, wherein the photo-alignment layer is formed by light-irradiation.

15. The device of claim 14, wherein the light-irradiation is irradiated at least once.

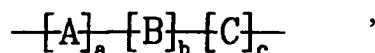
16. The device of claim 14, wherein the light is selected from a group consisting of unpolarized light, non-polarized light, linearly polarized light and partially polarized light.

17. The device of claim 10, wherein the rubbing alignment layer is selected from a group consisting of polyimide, polyamide, polyamic acid and SiO<sub>2</sub>.

18. A method of fabricating a liquid crystal display device comprising:  
 preparing a first substrate and a second substrate;  
 forming a photo-alignment layer at least on the first substrate, wherein the photo-alignment layer has an ethenyl group at a main chain; and  
 forming a liquid crystal layer between the first and second substrates.

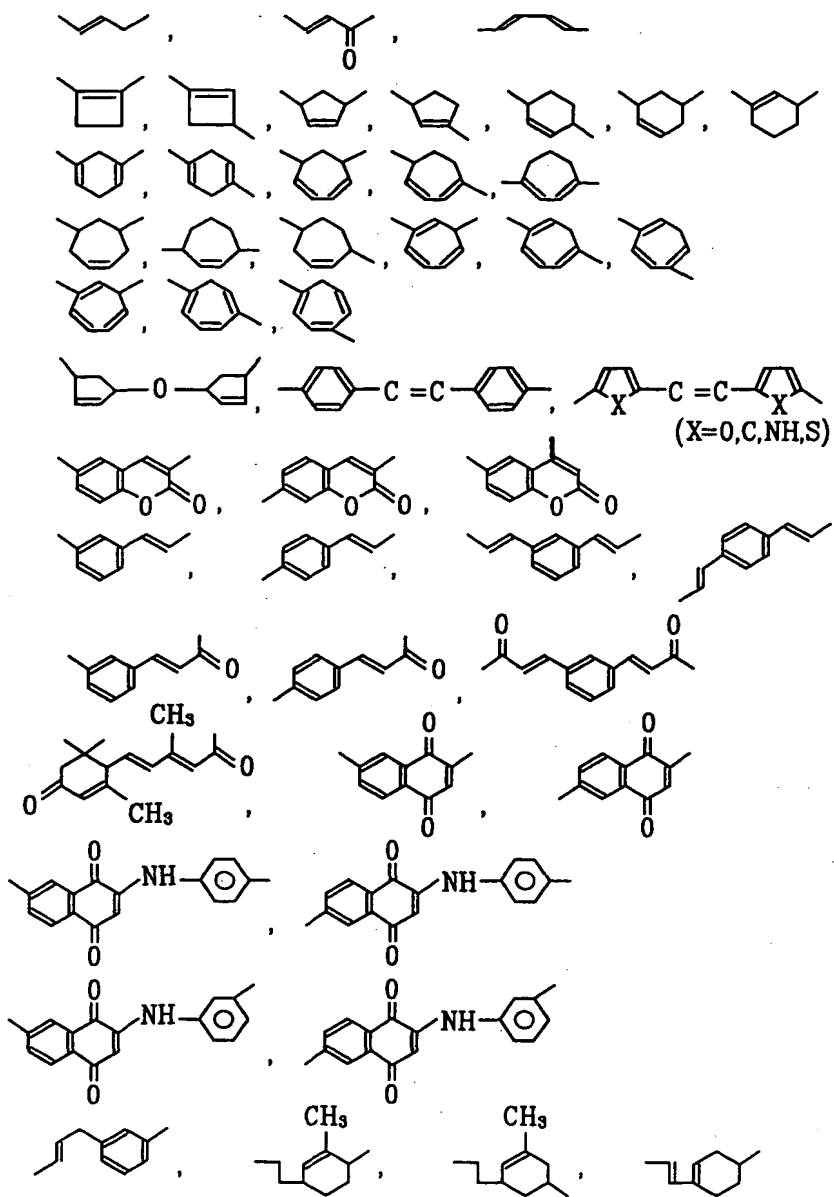
19. The method of claim 18, wherein the photo-alignment layer is formed of a material having a photo-reactive ethenyl group on a polymer main chain, wherein the polymer is denoted by the following chemical formula 1:

{chemical formula 1}



wherein subscripts a, b, and c denote a component ratio of respective monomers, wherein  $0 < a \leq 1$ ,  $0 \leq b < 1$ , and  $0 \leq c < 1$ , and wherein component A, which is a monomer including the photo-reactive ethenyl group, is selected from groups designated in chemical formula 2, substituted-structure groups of the chemical formula 2 with a halogen, cyano, nitro, amino group, and other substituted-structure groups with an alkyl and haloalkyl, and cyanoalkyl group having 1 to 10 carbons or an aryl, alkyl, aryl, haloaryl, haloalkyl aryl, nitroaryl, cyanoaryl group having 3 to 8 carbons;

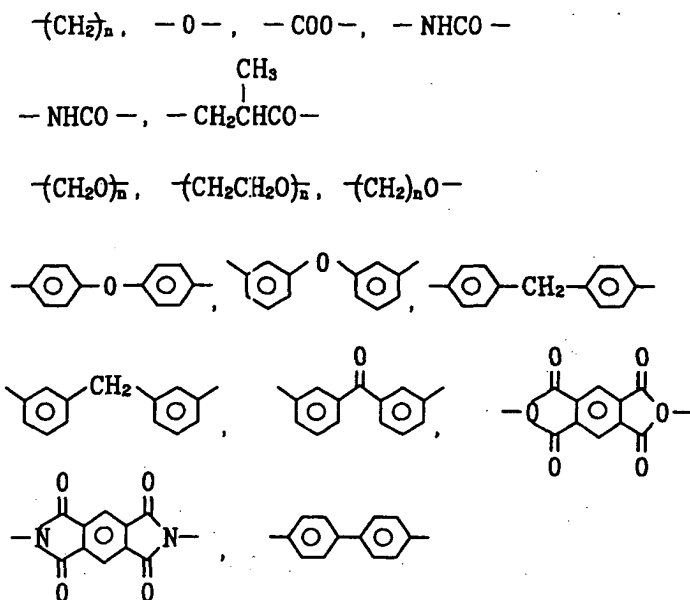
{Chemical Formula 2}



20. The method of claim 19, wherein components B and C are selected independently from groups shown in chemical formula 3, substituted-structure groups of the chemical formula 3 with a halogen, cyano, nitro, amino group, other substituted-structure groups with carbonated groups of which carbon number n lies between 1 and 10 such as an

alkyl, haloalkyl, and cyanoalkyl, and other carbonated groups of which carbon number lies between 3 and 8 such as an alkylaryl, haloaryl, haloalkylaryl, nitroaryl, cyanoaryl;

{Chemical Formula 3}



21. The method of claim 18, further comprising:

forming a gate line and a crossing data line on the first substrate;

forming a thin film transistor at a crossing between the gate and data lines; and

forming a pixel electrode connected to the thin film transistor.

22. The method of claim 18, wherein the photo-alignment layer is formed by light-irradiation.

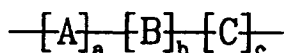
23. The method of claim 22, wherein the light-irradiation is irradiated at least once.

24. The method of claim 22, wherein the light is selected from a group consisting of unpolarized light, non-polarized light, linearly polarized light and partially polarized light.

25. A method of fabricating a liquid crystal display device comprising:  
 preparing a first substrate and a second substrate;  
 forming a photo-alignment on the first substrate, wherein the photo-alignment layer includes an ethenyl group at a main chain;  
 forming a rubbing alignment layer on the second substrate; and  
 forming a liquid crystal layer between the first and second substrates.

26. The method of claim 25, wherein the photo-alignment layer is formed of material having at least a photo-reactive ethenyl group at a polymer main chain, wherein the polymer is denoted by the following chemical formula 1:

{chemical formula 1}



wherein subscripts a, b, and c denote a component ratio of respective monomers, wherein  $0 < a \leq 1$ ,  $0 \leq b < 1$ , and  $0 \leq c < 1$ , and wherein component A, a monomer including the photo-reactive ethenyl group, is selected from groups designated in chemical formula 2, substituted-structure groups of chemical formula 2 with a halogen, cyano, nitro, amino group, and other substituted-structure groups with a alkyl and haloalkyl, and cyanoalkyl group having 1 to 10 carbons or an aryl, alkyl, aryl, haloaryl, haloalkyl aryl, nitroaryl, cyanoaryl group having 3 to 8 carbons;

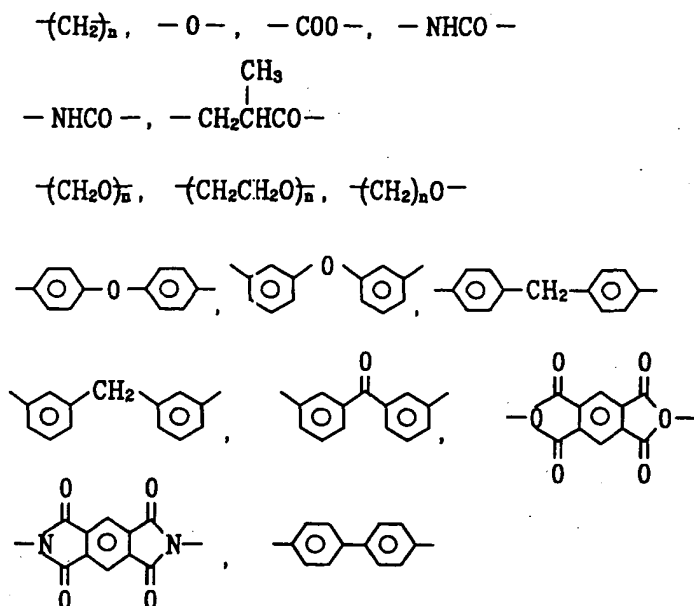
Chemical structures of various monomers and polymers, including alkenes, cycloalkenes, and aromatic compounds. The structures are arranged in rows, showing different ring sizes and substituents. A legend indicates that X can be O, C, NH, or S.

Legend:  $(X=O, C, NH, S)$

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cyanoalkyl, and other carbonated groups of which carbon number lies between 3 and 8 such as an alkylaryl, haloaryl, haloalkyl aryl, nitroaryl, cyanoaryl;

{Chemical Formula 3}



28. The method of claim 25, further comprising:

forming a gate line and a crossing data line on the first substrate;

forming a thin film transistor at a crossing between the gate and data lines; and

forming a pixel electrode connected to the thin film transistor.

29. The method of claim 25, wherein the photo-alignment layer is formed by light-irradiation.

30. The method of claim 29, wherein the light-irradiation is irradiated at least once.

31. The method of claim 29, wherein a light used for light-irradiation is selected from a group consisting of unpolarized light, non-polarized light, linearly polarized light and partially polarized light.

32. The method of claim 25, wherein the rubbing alignment layer is selected from a group consisting of polyimide, polyamide, polyamic acid and  $\text{SiO}_2$ .